





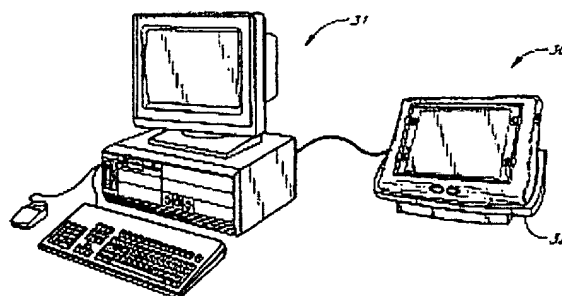


ELECTRONIC BOOK SYSTEM

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Publication date: 1999-09-30
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more >>**Abstract of WO9949383**

An electronic reading system (30, 31, 32) allows users to download book and other types of contents to a hand-held reader device (30) for viewing. Using software which runs on a personal computer (PC) (31), the user can download titles from Internet sites to the PC (31). Titles are then automatically transferred to the device when the device (30) is placed in a cradle (32) which is connected to the PC (31). Using the device's touch sensitive display (34) and graphical user interface, the user can access various software implemented features associated with the display and management content.



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Electronic book system

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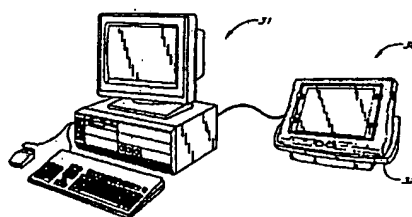
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[54]发明名称 电子书籍系统

[57]摘要

一电子阅读系统(30,31,32),允许用户下载书籍和其他种类内容至一手持阅读设备(30)用作阅览。用户可利用在个人计算机(PC)(31)上运行的软件,将专题从互联网网站下载至PC(31)。当设备(30)置于与PC(31)连接的基座(32)内时,专题接下来自动传送给设备。用户可利用该设备的触觉显示器(34)和图形用户界面,获得与该显示器和管理内容相关的靠软件实施的特性。



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1. 一种手持计算设备，适应于用户用来阅读著作作品，其特征在于，该设备包括：

支持处理器、存储器和触觉显示器的壳体；以及

存储于存储器内的多个专题，多个专题包括至少一个适应在显示器上作为著作作品阅览的著作专题，以及至少一个适应用作参考作品的参考专题；

其中处理器编程为通过执行下列步骤，来响应用户为了查阅对著作专题所显示项的选择：

(a) 标识与著作专题对应的参考专题；

(b) 对步骤(a)中标识的参考专题搜索所显示语项；以及

(c) 在触觉显示器上显示步骤(b)中的搜索结果。

2. 如权利要求1所述的手持计算设备，其特征在于，步骤(a)中标识的参考专题是双语间翻译器，步骤(c)包括在触觉显示器上显示对所显示语项的翻译。

3. 如权利要求1所述的手持计算设备，其特征在于，还包括与处理器相连的音频扬声器，其中步骤(c)还包括在该扬声器上输出可听的搜索结果。

4. 如权利要求3所述的手持计算设备，其特征在于，该可听的搜索结果包括对所显示语项的发音。

5. 如权利要求1所述的手持计算设备，其特征在于，处理器所实施的用户界面包括允许用户指定与一给定著作专题一起使用的特定参考专题的菜单选项，步骤(a)包括标识一用户已指定的参考专题。

6. 如权利要求1所述的手持计算设备，其特征在于，步骤(b)包括在参考专题内作为关键词搜索所显示语项。

7. 如权利要求1所述的手持计算设备，其特征在于，还包括将参考专题下载至

存储器的软件。

8. 如权利要求1所述的手持计算设备，其特征在于，处理器编程为响应用户点击所显示语项执行步骤（a）-（c）。

9. 如权利要求8所述的手持计算设备，其特征在于，处理器编程为响应用户连续两次点击所显示语项执行步骤（a）-（c）。

10. 如权利要求1所述的手持计算设备，其特征在于，参考专题和著作专题存储在单个文件中。

11. 如权利要求1所述的手持计算设备，其特征在于，与一基座和软件应用结合，该基座适应于接收该手持设备，以使该设备与通用计算机电气连接，该应用适应将包括著作作品和参考作品在内的作品传送给该手持设备。

12. 一种在一适合用来阅读著作作品的手持计算设备中有利于著作作品理解的方法，其特征在于，该方法包括下列计算机实施的步骤：

（a）在该设备的一触觉显示器上向用户显示著作作品，该著作作品以数字形式存储在该设备一存储器中；

（b）响应用户为了查阅而对著作作品所显示语项的选定，在参考作品中搜索该语项，该参考作品以数字形式存储在该设备的存储器中；以及

（c）在触觉显示器上显示步骤（b）的搜索结果。

13. 如权利要求12所述的方法，其特征在于，多个参考作品存储在该设备存储器中，该方法还包括识别与著作专题相对应的参考作品。

14. 如权利要求12所述的方法，其特征在于，该参考作品是双语间翻译器，步骤（c）包括在触觉显示器上对所显示语项的翻译进行显示。

15. 如权利要求12所述的方法，其特征在于，将专题存储的音频文件，步骤（c）还包括在触觉显示器上显示该音频文件的搜索结果。

电子书籍系统

发明领域

本发明涉及一种手持计算设备。具体来说，本发明涉及利用触觉显示器便于信息内容阅览和管理的用户界面以及其他软件特性。

发明背景

于1998年3月4日申请的美国专利申请09/034,720，公开了一种安全的内容发行系统，使用户能够安全地将著作专题和其他类型内容下载至手持阅读设备。利用阅读设备的控制按钮和触觉显示器，用户可执行诸如选择、阅览和删除专题，调整字体大小和所显示文本的取向，以及对选定的段落加上注语这些任务。因为专题是以数字形式传播和存放的，所以，与书籍以及其他类型印刷出版物的销售和发行相关的许多成本，包括与这些出版物的印刷、存放以及装运相关的成本，都被消除了。

为了使这种系统对公众有吸引力，重要的是该阅读设备具有使用时简单且直观的用户界面。另外，该设备所提供的功能应发挥内容为数字形式的优点，这样用户才会动心用此系统替代印刷出版物。此外，该设备还应在较长的阅览时间内拿着很舒服。

本发明正是针对上述以及其他问题的。

概述

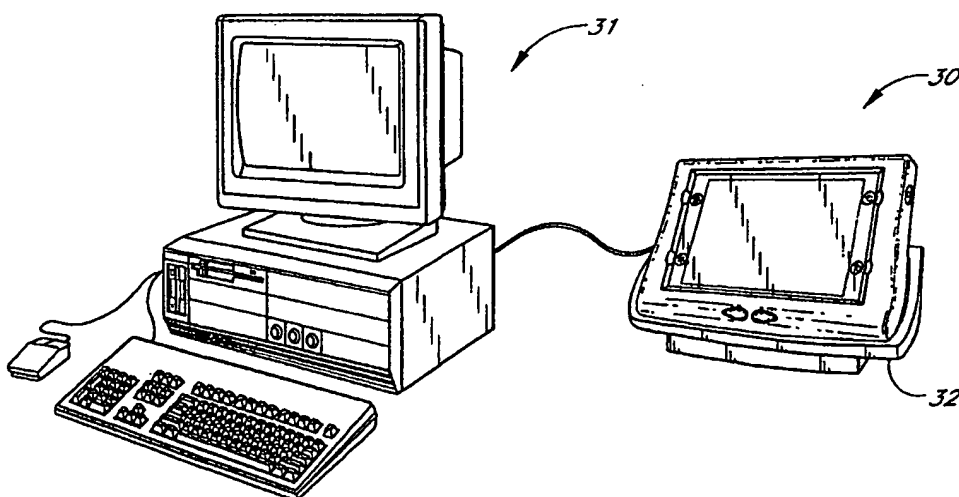
本发明包括一手持计算设备，适合用作一著作专题以及其他类型内容阅读用的阅读设备。该设备所包括的触觉显示器和图形用户界面提供与该设备存储器所存储专题的阅览相关的各种功能。在一较佳实施例中，该设备适合与PC或经一基座与其他通用计算机通信。

按照本发明一个方面，设备所实施的一自动查阅特性，可由用户启用来查阅所显示专题中一词语。利用此特性，用户可引发例如与所显示语项相关的定义、双语间翻译、音频发音、百科清单、图片或其他类型的参考清单。一实施例中，用户通过点击词语2次来查阅词语，一次为了选定该词语，第二次则启动该查阅处理。该设



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(54) Title: **ELECTRONIC BOOK SYSTEM**

(57) Abstract

An electronic reading system (30, 31, 32) allows users to download book and other types of contents to a hand-held reader device (30) for viewing. Using software which runs on a personal computer (PC) (31), the user can download titles from Internet sites to the PC (31). Titles are then automatically transferred to the device when the device (30) is placed in a cradle (32) which is connected to the PC (31). Using the device's touch sensitive display (34) and graphical user interface, the user can access various software implemented features associated with the display and management content.

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ELECTRONIC BOOK SYSTEM

FIELD OF THE INVENTION

5 The present invention relates to hand-held computing devices. More particularly, the present invention relates to user interface and other software features for facilitating the viewing and management of informational content using a touch-sensitive display.

BACKGROUND OF THE INVENTION

10 U.S. Patent Application No. 09/034,720, filed March 4, 1998, discloses a secure content distribution system which enables users to securely download literary titles and other types of content to a hand-held reader device. Using the reader device's control buttons and touch-sensitive display, users can perform such tasks as selecting, viewing and deleting titles, adjusting the font size and orientation of displayed text, and adding notes to selected passages. Because the titles are disseminated and stored in digital form, many of the costs associated with the sale and distribution of books and other types of printed publications are eliminated, including the costs associated with
15 printing, storing and shipping of such publications.

In order for such a system to appeal to the mass public, it is important that the reader device have a user interface which is simple and intuitive to use. In addition, the device should provide functions which take advantage of the content's digital form, so that users have the incentive to use the system in place of printed publications. Further, the device should be comfortable to hold during prolonged viewing session.

20 The present invention addresses these and other problems.

SUMMARY

The present invention comprises a hand-held computing device that is adapted to be used as a reading device for the reading of literary titles and other types of content. The device includes a touch-sensitive display and a graphical user interface that provide various functions associated with the viewing of titles stored in the device's
25 memory. In a preferred embodiment, the device is adapted to communicate with a PC or other general purpose computer via a cradle.

In accordance with one aspect of the invention, the device implements an automatic look-up feature which can be invoked by the user to look up a word of a displayed title. Using this feature, the user can, for example, bring up a definition, language-to-language translation, audible pronunciation, encyclopedia listing, picture, or other
30 type reference listing associated with the displayed term. In one embodiment, the user looks up the word by tapping the word twice — once to select the word and a second time to initiate the look-up process. The device responds by searching for the word in a pre-specified or default reference title (dictionary, encyclopedia, etc.) and displaying the results on the display. The reference titles can be downloaded to the device by the user, and can be designated for use with specific literary titles using the device's user interface.

35 In accordance with another aspect of the invention, the touch-sensitive display has a fixed icon displayed thereon which represents a user-definable function key or "hotkey." Using the hotkey, the user can execute a

commonly-used menu or sub-menu item (function), such as a "Set Bookmark Here" function, with a single touch of the display. To assign a function to the hotkey, the user initially brings up one of the device's menus on the display, such as by touching a "book menu" or "library menu" key. The user then performs an intuitive drag-and-release operation from the hotkey to the target menu item, or vice versa. Thereafter (until a subsequent reassignment), the target menu item is executed immediately whenever the user touches and releases the hotkey with no menu displayed on the screen.

In accordance with another aspect of the invention, the device supports a citation routing feature which allows a user to select a passage on the touch-sensitive display and then designate a destination for the subsequent routing of the passage by the general purpose computer. In a preferred embodiment, the user initially highlights the passage on the display and then taps once on the passage to bring up a menu of routing options. From this menu, the user can select one or more routing addresses, including email addresses, fax numbers, file folders and printers. In addition, the user can type-in an optional annotation using a pop-up keyboard.

Once this process is complete, the device preferably creates a citation file which indicates the passage and destination(s) selected by the user. When a communications link is subsequently established between the device and the general purpose computer (such as by placing the device in the cradle), the citation file is automatically transferred to the computer (together with any other citation files that have been created but not yet transferred). A software application running on the general purpose computer in-turn routes the passage and optional annotation to the user-specified destination(s).

In accordance with another aspect of the invention, the device includes an orientation key which can be touched by the user to bring up four orientation markers on the screen, each of which corresponds respectively to one of the four possible display orientation settings (0, 90, 180 or 270 degrees relative to a base or gripping portion of the device). Each of the markers is preferably in the form of an arrow which points to one of the four edges of the display. To select a display orientation, the user simply touches the arrow that points to the desired top of the display. When the user places the device in the cradle, the device automatically resets the orientation to the base (zero degrees) setting to facilitate the viewing of content while the device is in the cradle.

BRIEF DESCRIPTION OF THE DRAWINGS

These and other features will now be described with reference to the drawings summarized below. These drawings and the associated description are provided to illustrate a preferred embodiment of the invention, and not to limit the scope of the invention.

Figure 1 illustrates the physical user components of a content distribution and display system in accordance with the present invention.

Figure 2 is a perspective view of the hand-held reader device of Figure 1.

Figure 3 is a side view of the device, illustrating an expanded base portion that may be used to conveniently hold the device in one of four supported orientations.

Figure 4 illustrates the general software architecture of the system, including components that may be used to securely distribute literary titles to users.

Figure 5 illustrates the general hardware architecture of the device.

Figures 6 and 7 illustrate, in example form, a hotkey assignment feature of the device's user interface.

Figure 8 illustrates a sequence of program steps that are performed by the device to implement the hotkey assignment feature.

5 Figures 9 and 10 illustrate, in example form, a reference titles feature that enables users to look up selected terms within a pre-specified or default reference title.

Figure 11 illustrates a sequence of program steps that are performed to implement the reference titles feature.

10 Figures 12 and 13 illustrate, in example form, a citations feature that can be used to route a selected passage to one or more destinations.

Figure 14 illustrates a sequence of program steps that are performed by the device to build a citation file.

Figure 15 illustrates a sequence of program steps that are performed by the device to transfer the citation files to the PC.

15 Figure 16 illustrates a sequence of program steps that are performed by the PC to retrieve, process and route the citation files.

Figures 17 and 18 illustrate, in example form, a screen orientation feature of the device.

Figure 19 illustrates a sequence of program steps that are performed by the device to implement the screen orientation feature.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

20 Throughout the following description, reference will be made to various implementation-specific details, including, for example, specific standards that are used in the computer industry. These details are provided in order to fully set forth a preferred embodiment of the invention, and not to limit the scope of the invention. The scope of the invention is set forth in the appended claims.

I. System Overview

25 Figures 1-5 illustrate a content distribution and display system which incorporates the various features of the invention. The system includes a hand-held computing device 30 that is adapted to be used as a portable reading device for allowing a user to read literary titles (books, journal articles, newspapers, memoranda, emails, etc.) and other types of content via a touch sensitive display 34. The titles are preferably downloaded to the device 30 in digital form from a Personal Computer (PC) 31 (Figure 1) using a docking station or "cradle" 32. Using the device's
30 user interface (described below), a user of the device can perform such tasks as selecting titles to view, adjusting the font size and orientation of the displayed text, deleting titles from memory, and attaching notes and bookmarks to the displayed text.

35 In accordance with the invention, various software features are provided for facilitating the management and display of content using the device's touch sensitive display 34. Prior to describing these features, an overview will be provided of the general construction and operation of the hand-held device 30 and related components. As

will be apparent from the following disclosure, the features of the invention may be incorporated into other types of hand-held computing devices that have touch-sensitive displays.

As illustrated by Figure 2, the reader device 30 includes a housing 33 which has respective openings for a touch-sensitive display 34, an ON/OFF button 36, and UP and DOWN scroll buttons 38. The back of the housing (not shown) has an opening formed therein for holding a stylus, and includes a multi-pin connector 40 (Figure 5) for connection to the cradle 32. The device 30 also includes an audio speaker 44 (Figure 5) for outputting digital audio signals, and includes an infrared (IrDA) transceiver 46 (Figure 5) for communicating with kiosks, PC's, other infrared devices, or another hand-held device.

As illustrated by Figures 2 and 3, the housing 33 has an increased width and depth and a rounded configuration along its base to form an extended gripping area 50 for holding the device. The gripping area 50 is sized to correspond generally to a typical user's hand, and includes a curved portion which extends along the back side of the device to accommodate the user's fingers. As described below, the gripping portion is adapted to be used to hold the device in multiple different device orientations.

The gripping portion 50 houses one or more elongated, rechargeable batteries 51 (Figure 5) that are used to power the device 30, and is thus heavily weighted in comparison to the remaining portions of the device. An important advantage of this device configuration and weight distribution is that it reduces stress on the user's hands and wrists during prolonged reading sessions. This feature, combined with the ability to change this display orientation (discussed below), facilitates the ability for the user to find a comfortable reading position.

As depicted by Figures 1 and 4, the reader device 30 is adapted to be used as part of a secure content distribution system which includes the PC 31, the cradle 32, and various software components. The cradle 32 plugs into the serial port (not shown) of the PC, and also plugs into a standard power outlet. Included within the content distribution system are one or more client applications which run on the PC 31. Using these applications, the user can purchase and download literary titles (novels, textbooks, journal articles, etc.) from Internet and other network sites to the PC, and subsequently transfer these titles to the device 30 for viewing. The device 30 may additionally or alternatively be provided with browser software and a modem for allowing the user to download titles to the device directly. Titles may additionally or alternatively be retrieved by the PC from a physical storage medium, such as CD-ROM or a DVD disk.

One type of PC application, which may be in the form of a browser plug-in, provides functionality for allowing a user to interactively purchase and download titles from Web sites. The PC 31 may also run a client application which retrieves free and/or subscription titles automatically (such as by implementing a "push" protocol) from network sites based on pre-specified preferences or subscription profiles of the user.

Regardless of the type of title retrieval method used, the titles that are stored on the PC 31 are preferably automatically transferred to the device 30 when the device is placed in the cradle 52. The software running on the PC may additionally or alternatively be configured to allow the user to initiate title transfers manually. The cradle 52 also acts as a charging station for automatically charging the device's batteries.

In one implementation, the device's software supports both the US ASCII and the Unicode character encoding standards. The use of Unicode allows the device to be used to display titles of multiple different written languages. The device is also capable of displaying graphics images, and playing sound clips, that are embedded within the titles. The system software also supports standard markup languages such as HTML (HyperText Markup Language), and supports the use of hyperlinks to navigate within and between titles.

In one embodiment, the device includes a speech synthesizer application which converts encoded text (ASCII, Unicode, etc.) into audible speech. Using this application, a user can listen to a selected title. The speech synthesizer application is preferably configured to automatically scroll and highlight the text on the display 34 in synchronism with the audible output, so that the user can optionally "follow along" with the synthesized speech. This feature may be used, for example, to assist the user in learning a new language or to assist the vision-impaired.

Titles may optionally be downloaded from Internet sites and transferred to the device 30 in an encrypted form, in which case the encrypted titles are decrypted by the device "on-the-fly" as the titles are viewed. Preferably, the titles are encrypted (typically by server software running on a Web site) using a public key that corresponds uniquely to a particular device 30 or the user, and are decrypted using a private key which is stored within the device. When the user purchases an encrypted title, the user identifies the device to the network site using a unique identifier, and does not need to know (and does not have access to) the private key. This distribution method protects the content from being accessed by unauthorized users.

In one embodiment, two sets of public/private key combinations or "certificates" are used. The first certificate is assigned in the factory during the manufacturing process and is called the "Device Certificate." The Device Certificate corresponds to a particular device 30 and allows a key administration entity to have a protected conversation with the device. The second certificate is assigned and downloaded to the device during the user registration process and is called the "User Certificate." The User Certificate follows the particular user (i.e., can be transferred from one device to another), and is used to encrypt and decrypt titles. This approach allows the user to upgrade and/or replace the physical device 30 without losing access to existing titles that have been encrypted for the user.

Figure 4 illustrates the general software architecture of the reader device and associated PC software, and also illustrates the general server architecture of a secure content distribution system. Additional details of the secure content distribution system are provided in U.S. Appl. No. 09/034,720, filed March 4, 1998, the disclosure of which is hereby incorporated by reference in its entirety.

As depicted by Figure 5, the device 30 is controlled by a Sharp LH77790 microprocessor 73 which accesses three types of memory: an EPROM 66, a FLASH array 68, and a DRAM array 70. The EPROM 60 is used primarily to store system software used during initial boot-up, along with certain security keys. The FLASH array 68 is used primarily to store system software, the user and device keys, titles and software applications. Titles that are downloaded to the device in encrypted and/or compressed form are maintained in such form in FLASH memory, and are written to DRAM as they are decrypted and decompressed for viewing. Other details of the hardware architecture are set forth in the above-referenced application.

The device 30 preferably operates under the control of a proprietary operating system developed by NuvoMedia Inc., but may alternatively operate, for example, under the control of the Windows CE™ operating system from Microsoft Corporation. The PC applications run under the Microsoft Windows™ family of operating systems, but may be adapted to run on Mac OS, Unix, and other platforms.

5 With reference to Figures 2 and 5, the device's touch-sensitive display 34 includes a touch screen 74 which is mounted on top of an LCD display 76 (the perimeter of which is denoted by 76A in Figure 2). The LCD display 76 is equipped with a backlight (not shown) which can be turned ON and OFF using the power button 36. The touch screen 74 extends to or slightly beyond the inward-facing edge 78 of the device's bezel. In one implementation, the touch screen 74 is a Panasonic EMU-601A2N400 device.

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11. Overview of User Interface

As illustrated by Figure 2, the portion of the touch screen 74 which extends beyond the perimeter 76A of the LCD display 76 has four fixed icons displayed thereon to form four respective function keys: an orientation key 80, a user-definable "hotkey" 82, a book menu key 84, and a library menu key 86. Each icon is in the form of an orientation-independent image that conveys meaning regardless of the orientation in which the device is being held. For example, in any of the four possible device orientations, the orientation icon 80 appears as a page of text that is being rotated.

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When the orientation key 80 is touched, the device displays four arrows (Figure 27), each of which can be touched to select one of four possible display orientations (0, 90, 180 or 270 degrees relative to the base 50 of the device). Using this feature, the user can select a text orientation which corresponds to the user's preferred device orientation and gripping method. For example, a left-handed user may choose the device/text orientation in which the gripping area 50 falls on the left-hand side of the device (as in Figure 6), and a right-handed user may choose the opposite orientation. The combination of the weight-concentrated gripping area 50 and the ability to change the display orientation allows the device to be used in multiple different orientations without sacrificing comfort. The screen orientation features of the device are discussed further below.

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When the user touches the hotkey 82, the device 30 performs a function (the "hotkey function") that is currently assigned to the hotkey 82. As described separately below with reference to Figures 6-8, one aspect of the invention is a user interface feature which allows a user to rapidly and intuitively designate the hotkey function.

When the user presses the book menu key 84 or the library menu key 86, the device 30 displays a book menu 85 (Figure 6) or a library menu (not shown), respectively. The book menu 85 includes various menu items which pertain generally to the title that is currently being viewed. The library menu contains menu items which pertain generally to the library of literary titles that are currently stored within the device 30. The menu and sub-menu items of the book and library menus are listed and summarized in Table 1.

30

| Menu Item | Description |
|--|---|
| Book Menu/Highlight | Toggles mode which allows user to touch words, lines and paragraphs to permanently highlight them. |
| Book Menu/Large Text | Toggles page display between normal and large fonts. |
| Book Menu/Add Note | Causes a user note to be attached to the selected text, or if no text is selected, to the current page. |
| Book Menu/Set Bookmark Here | Sets a bookmark to the selected text, or if no text is selected, to the current page. The first few words of the selection are used as the default identifier of the bookmark. |
| Book Menu/Goto Bookmarks | Displays a list of the bookmarks for the title, including both bookmarks defined by the publisher (such as "index" and "table of contents") and bookmarks defined by the user. From this list, the user can either goto or delete a displayed bookmark. |
| Book Menu/Search | Displays a sub-menu of search options (see below). |
| Book Menu/Search/Lookup | Searches the displayed title for a text string. The string can be selected before invoking this function, or can be entered using a pop-up keyboard. |
| Book Menu/Search/"other tags" | Takes the user to the publisher-defined tags. These tags are incorporated into the Search menu automatically. |
| Book Menu/Set References | Allows the user to designate one or more reference titles to be used in place of a default reference title. |
| Library Menu/Bookshelf | Displays of list of the titles currently stored on the device. From this list the user can delete titles or select a title for reading. |
| Library Menu/Desktop Supplies | Displays a list of additional programs available on the device. |
| Library Menu/Set Citation Destinations | Allows user to create lists of destinations (email addresses, fax numbers, etc.) for routing selected passages. The destination lists can alternatively be generated on the PC and transferred to the device. |
| Library Menu/"title" | The library menu always displays the four most recently used literary titles. Touching a title will cause the title to be opened. |

TABLE 1

III. Assignment of Hotkey Function

The hotkey function can be any of the menu items listed in Table 1. When the hotkey 82 is touched and released, the device 30 executes this function. The hotkey feature thus allows a user to quickly invoke a commonly used menu or sub-menu function with a single touch of the screen.

With reference to Figure 6, the menu or sub-menu item that is currently defined as the hotkey function is denoted as such by a hotkey icon 90. In this example, the hotkey icon 90 appears next to the "Goto Bookmarks" item of the book menu. With this hotkey assignment, the device 30 will display a list of bookmarks when the hotkey 82 is touched. If the current hotkey function has a sub-menu associated with it, touching and releasing the hotkey 82 will cause this sub-menu to be displayed.

An important feature of the device is a user interface method for allowing the user to define the hotkey function using an intuitive drag-and-release technique. This method is illustrated in example form by Figures 6 and 7. With reference to Figure 6, the user initially brings up the menu or sub-menu that contains the target hotkey function. As depicted by Figure 7, the user then touches the hotkey 82 with the stylus 92 (or the user's finger), drags the stylus to the target item, and then removes the stylus from the touch screen 74.

During the dragging process, the hotkey icon 90 is displayed next to the menu item (if any) that is currently touched. In Figure 7, for example, the hotkey icon 90 is displayed next to the "Highlight" item since the stylus 92 is currently over that item. This feature allows the user to readily identify the item that will be assigned as the hotkey function when the stylus 92 is lifted from the screen. The selected item may additionally or alternatively be displayed in a highlighted form. In addition, a shadowed, grayed, or other representation of the hotkey icon may follow the stylus tip during the dragging process.

If, during the dragging process, the stylus is moved away from the menu 85, the hotkey icon either (a) reappears next to the currently-assigned hotkey function (if this function appears in the displayed menu), or (b) disappears from the display (if the currently-assigned hotkey function does not appear in the displayed menu). If the stylus 92 is not over a menu item when the stylus is withdrawn from the screen 74, the prior hotkey assignment remains in effect.

In other implementations, the device 30 may additionally or alternatively be configured to allow the user to assign the hotkey function by dragging and dropping the target menu item onto the hotkey 82. With this alternative method, the user touches the menu item, drags the item across the screen 74 to the hotkey 82 (during which a shadowed or dulled representation of the item preferably moves across the screen with the stylus), and then removes the stylus from the screen. The hotkey icon 90 is then displayed next to the menu item to indicate that the operation was successful. In addition, although the hotkey 82 in the preferred embodiment is a fixed icon on the touch screen 74, the above method can also be used to assign a function to an electronically-displayed hotkey.

Figure 8 is a flow diagram of a software routine that is used to implement the Figure 7 technique. This routine is invoked when the hotkey 82 is initially touched. As represented by steps 100-104, if no menu is open when the hotkey is touched, the program waits for the user to lift up from the screen and then executes the current hotkey function. If, on the other hand, one or more menus are currently open, the program enters into a hotkey assignment sequence (steps 106-114).

In step 106, the program determines whether the touched area is over a menu item. If it is, and the touched menu item is not currently marked with the hotkey icon, the hotkey icon is moved to the touched item (step 108). If it is not, and the current hotkey item is not marked, the hotkey icon is moved to the current hotkey item

(step 110), which may or may not be displayed on the screen. As indicated by steps 112 and 114, this process is continued until the user lifts up on the screen, at which time the marked menu item is set as the current hotkey function.

As indicated above, the program may additionally or alternatively support dragging and dropping the menu item to the hotkey. In addition, in one embodiment, the hotkey function can be assigned by dragged the hotkey icon directly from one item to another item that appears in the same menu or sub-menu.

IV. Reference Titles

Another important feature involves the ability of the user to look up a word or phrase using a default or pre-specified reference title. This feature of the device is illustrated in Figures 9, 10 and 11, which demonstrate the use of the feature to look up a translation of a selected term.

As depicted by Figure 9, the user initially selects the term by tapping it once. If the user then taps the selected term a second time, a sequence of steps is initiated in which the device attempts to locate an appropriate reference title, and if one is found, searches for the selected term. If a reference title is located, a pop-up window 130 (Figure 10) is used to display the results of the search. If no reference title is found, a pop-up window appears which displays an error message, such as a message which gives the user the option of designating a reference title for the title being viewed.

In addition to including textual results, a reference title may include graphical images that are displayed in the pop-up window 130, and/or audio search results that are played back on the speaker. For example, a dictionary reference title may include audible pronunciations that are played back concurrently with the display of the definition, or that are played back if the user taps the look-up term within the pop-up window 130. In other embodiments, the device 30 may be capable of playing back video and multimedia clips that are stored within the reference titles. To enable the search software to discriminate between the look-up terms and the associated content (definitions, audio, etc.), the look-up terms are tagged within the reference title document as keywords.

As with literary titles, reference titles ("references") can be retrieved using the PC and downloaded to the device 30, and many different references can reside on the device concurrently. Examples of the different types of references that can be used include linguistic dictionaries, language-to-language dictionaries, dictionaries specific to a given technical field (e.g., medicine), encyclopedias, and thesauruses. Using appropriate software which runs on the PC, the user may also be provided the option of creating a "custom" reference to be downloaded to the device 30.

The reference for a given literary title can be designated by the user using the "Set References" menu item (Table 1) of the book menu. If no reference has been designated for the title when the look-up is initiated, the device 30 attempts to locate a default reference using various classification tags that are embedded within the literary and reference titles. These tags may include, for example, a language tag which indicates the title's primary language, and a category tag which indicates any special category or categories that the title falls within (e.g., medicine, physics, electronics, law, etc.).

In the preferred embodiment, the reference titles and the literary titles are downloaded and stored separately from one another. In other implementations, the two types of titles can alternatively be combined within a single title. For example, a publisher could sell an electronics textbook which has one or more corresponding reference titles embedded therein.

5 In one embodiment, the user can designate primary and secondary references for a given title. The device 30 will then search the secondary reference (or references) only if no match is found in the primary reference. The device may also be configured to jump directly to the secondary reference (rather than initially searching the primary reference) when the user preforms a specific action, such as tapping on the term three times in rapid succession. Using this feature, a user could, for example, set up the device such that tapping on the word twice brings up a
10 dictionary definition while tapping on the term three times brings up a translation or audible pronunciation.

 Figure 11 illustrates one embodiment of a software routine which can be used to implement the look-up feature depicted in Figures 9 and 10. The routine is invoked when the user taps twice on a word of a literary title (once to select the word, and a second time to initiate the search). As represented by step 140, the program initially determines whether a special reference has been designated for the title, and if so, whether the reference is present
15 in memory. A special reference may be designated either by the publisher or by the user, and may be specified within the literary title using a special tag.

 If no special reference is located, the program begins to search for an appropriate default reference. In this example, the program first checks the title's category tag (if any) and searches for a reference that corresponds to the title's category (step 142). If multiple matching references are found, the user may be prompted to designate
20 one of the references as a default for that category. If no category-based reference can be found, the program checks the language tag (if any) of the title and searches for a corresponding language-based reference (step 144). If multiple language-based references are found, the user may be prompted to select a default reference to be used for that language.

 As depicted by steps 148-152, once a reference has been found, the program opens the reference and
25 searches for the selected term as a reference keyword. As part of this step, the program initially determines whether the reference is marked as being ordered alphabetically, and if so, performs the search as a binary keyword search or other such search technique. The results of the search (definition, "not found" message, etc.) are displayed in the pop-up window 130, which is cleared upon subsequent user activity.

 As depicted by step 154, an appropriate error message is displayed if no reference is found.

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V. Selection and Routing of Content

 Another important feature of the reader device 30 is that it allows the user to define a "citation" which includes one or more passages from a displayed title, and then specify one or more destinations addresses (email addresses, fax numbers, printers, etc.) for routing the citation. When the user subsequently establishes a
35 communications link between the PC and the reader device 30 (such as by placing the device in the cradle 32), any

citations that have been defined by the user are automatically uploaded to the PC, and a utility running on the PC automatically routes the citations to the specified destinations.

This feature of the invention is illustrated in example form by Figures 12 and 13. As illustrated by Figure 12, the user initially uses the stylus to block a segment 160 of content, which in the Figure 12 example consists of one paragraph of text. In a preferred embodiment, the device supports several different methods for blocking text, any of which can be used for this purpose. For example, through appropriate menus, the user can configure the device such that tapping anywhere on a paragraph causes the entire paragraph to be selected, or such that tapping on a sentence causes the sentence to be selected. The user can alternatively use a touch-and-drag method to select the passage.

With reference to Figure 13, the user can then tap once on the selected passage 160 to bring up a dialog box 162. If the user then selects the "Add Annotation" item, a pop-up keyboard (not shown) and editing screen are displayed for allowing the user to type in an annotation. The user may also be presented with the option of adding additional passages to the citation.

As illustrated in Figure 13, the dialog box 162 includes a list of the categories of destinations that can be selected for routing the citation. In the preferred embodiment, the user can route the citation to a printer, a file cabinet or folder object on the PC, an email address, a fax machine, or a combination thereof. When the user taps on one of these destination categories, the device either marks the destination category type as selected (if only one predefined destination exists for that category), or displays a list of the destinations that exist for that category (if multiple destinations have been defined). For example, the user can select the "To Email" category, and then select one or more email addresses from a personal address book.

Once all of the destinations have been specified and any annotation has been typed in, the user taps the OK button to complete the citation definition process. The device then uses the information specified by the user to build a citation file to be transferred to the PC. The citation file is preferably created such that the original formatting (font size, appearance, etc.) of the text is preserved.

Figure 14 illustrates a program sequence that may be used to generate an HTML citation file. It will be appreciated that other markup languages and/or file formats could alternatively be used. As depicted by Figure 14, the program creates the citation file (step 170) and then inserts into the file the following elements: a header with the user-specified destination information (step 172), HTML start and end tags (steps 174 and 182), any annotation typed in by the user (step 175), any HTML formatting tags in effect at the start of the passage (step 176), pointers to the start and end of the passage (step 178), and applicable tags specifying the title, author, publisher, and date of the title and the chapter and verse of the passage (step 180). The file is then closed (184), and is thereafter maintained in memory until it is either successfully transferred to the PC or deleted by the user.

Step 176 (inserting HTML formatting tags in effect) involves searching the text which precedes the passage to identify any formatting tags that apply to the passage. The purpose of this step is to preserve the passage's formatting. For example, if the passage consists of the second sentence of a paragraph which is in bold and italics,

this step will result in bold and italics tags being added to the file (just before the passage) so that these formatting attributes are preserved.

Step 178 (adding pointers) is performed in lieu of copying the passage over to the file. The purpose of this step is to conserve memory. When the citation file is later transferred to the PC, the pointers are replaced with the actual content of the passage. One potential problem with this approach is that the user may delete the title before the citation file is transferred to the PC. One method for avoiding this problem is to block the file from being deleted until the citation file has been transferred. Another method is to automatically copy the passage over to the citation file when the title is selected for deletion.

When the user places the reader device 30 in the cradle 32, or otherwise establishes a communications link between the device and the PC (such as via the infrared port or a modem), the PC sends a request to the device (assuming the associated PC application is running) for any new citation files that have been created. As depicted by Figure 15, the device responds to the request (assuming one or more citation files have been created) by inserting the referenced passages into the citation files (step 190), transferring the citation titles to the PC (step 192), and waiting (for a timeout period) for routing confirmations from the PC (step 194). As depicted by steps 196-202, the device then deletes any files that are confirmed, and displays an error message if less than all of the citation files are confirmed.

Figure 16 illustrates a program that is executed on the PC when the reader device 30 is initially detected within the cradle, with emphasis on the steps that are performed to retrieve and route the citation files. As represented by steps 212 and 214, the program initially queries the device to determine whether any new citation files have been created. If no citation files exist, the program immediately performs other housekeeping tasks (step 228), such as downloading any new titles to the device 30.

If one or more citation files exist, the program initiates a transfer of the citation files to the PC (step 216). For each citation file, the program strips off the header (step 220), routes the citation to the appropriate destination(s) (step 222), and returns a routing confirmation message to the device (step 224). As represented by steps 222A-D, citation files that are addressed to a folder are copied by the program to that folder; and citation files that are routed to a printer, fax number or email address are routed using the respective operating system (OS) API (application program interface) of the Windows™ or other operating system. Once all of the citation files have been routed, the program initiates the other housekeeping tasks (steps 226 and 228).

30 VI. Screen Orientation

The screen orientation features will now be described in further detail with reference to Figures 17-19.

As illustrated by Figure 17, pressing the orientation key 80 causes four graphical orientation markers 240-246 to be superimposed over the displayed text adjacent to respective edges of the display. The markers 240-246 are in the form of arrows which point to the four respective edges of the display, with each arrow representing one of the four possible display orientation settings. The marker that corresponds to the current setting (240 in this example) is shown in a highlighted form.

To select a new orientation setting, the user taps the marker that points to the desired to edge of the display. This causes the device to clear the markers and repaint the displayed text using the new orientation (if different from the current orientation). For example, if the user taps on arrow 246 in Figure 17, the text will be redisplayed with the orientation shown in Figure 18. This feature of the device allows the user to quickly (with only
5 two taps) and intuitively select a display orientation that corresponds to the user's device orientation preference.

An important aspect of this method is that it does not involve the use of textual menu items or other orientation-specific controls. As a result, there is no impediment to placing the device in the desired physical orientation prior to adjusting the display orientation. Thus, for example, the user can adjust the orientation as follows: Initially, the user can experiment with multiple different device orientations and gripping methods until a
10 comfortable position is found. Once such a position is found, the user can simply touch the orientation-independent rotation icon 80 and then select the arrow that points to the top of the screen.

This method provides significant advantages over menu-based methods for adjusting the display orientation, such as the method used by the Apple Newton™ PDA device. With the Newton device, the user selects one of the three following possible display rotation options from a drop down menu: (a) a counter-clockwise arrow together with the word "left," (b) a clockwise arrow together with the word "right," or (c) a relatively long clockwise arrow together with the term "180°." One problem with the Newton method is that it essentially requires the user to hold
15 the device in the "original" orientation (to maintain the readability of the drop-down menu) as the display orientation is adjusted. Another problem is that the user must mentally identify and then select the display rotation option that corresponds to the planned device rotation. The present method of adjusting the display orientation overcomes these
20 limitations.

Figure 19 illustrates the steps that are performed when the user touches the orientation key 80. The program initially superimposes the orientation markers on the screen as in Figure 17 (step 250), and then waits until one of the markers is touched (step 252). Upon detecting such a touch event, the program clears the display, repaints the display using the selected orientation setting, and records the setting in memory (steps 256 and 258).

Another feature of the reader device 30 is that it automatically resets the orientation to the base setting (as in Figure 18) when the device is placed in the cradle 32. This facilitates the viewing of information while the device is in the cradle. In one embodiment, the reader device can be configured by the user to automatically return the orientation to its pre-cradle setting upon removal of the device from the cradle.

The device 30 preferably detects that it has been placed in or removed from the cradle 32 by a sensing a grounded pin on the cradle. Upon detecting the grounded pin, the device 30 executes a service routine the records the current orientation setting and then resets the orientation to the base setting. A similar routine may be executed upon removal of the device from the cradle to restore the orientation to the prior setting.

Although this invention has been described in terms of certain preferred embodiments, other embodiments that are apparent to those of ordinary skill in the art are also within the scope of this invention. Accordingly, the
35 scope of the present invention is intended to be defined only by reference to the appended claims. In the claims

which follow, reference characters used to designate claim steps are provided for convenience of description only, and are not intended to imply any particular order for performing the steps.

WHAT IS CLAIMED IS:

1. A hand-held computing device that is adapted to be used by a user to read literary works, the device comprising:
 - a housing which supports a processor, memory, and a touch-sensitive display; and
 - 5 a plurality of titles stored within the memory, the plurality of titles including at least one literary title that is adapted to be viewed on the display as a literary work, and at least one reference title that is adapted to be used as a reference work;
 - wherein the processor is programmed to respond to user selection of a displayed term of a literary title for look-up by performing at least the following steps:
 - 10 (a) identifying a reference title that corresponds to the literary title;
 - (b) searching the reference title identified in step (a) for the displayed term; and
 - (c) displaying results of the search in step (b) on the touch-sensitive display.
2. The hand-held computing device according to Claim 1, wherein the reference title identified in step (a) is a language-to-language translator, and step (c) comprises displaying a translation of the displayed term on the touch-sensitive display.
3. The hand-held computing device according to Claim 1, further comprising an audio speaker coupled to the processor, and wherein step (c) further comprises outputting audible search results on the speaker.
4. The hand-held computing device according to Claim 3, wherein the audible search results include an audible pronunciation of the displayed term.
5. The hand-held computing device according to Claim 1, wherein the processor implements a user interface which includes a menu option for allowing a user to designate a specific reference title to be used with a given literary title, and wherein step (a) comprises identifying a reference title that has been designated by the user.
6. The hand-held computing device according to Claim 1, wherein step (b) comprises searching for the term within the reference title as a keyword.
7. The hand-held computing device according to Claim 1, further comprising software for downloading reference titles to the memory.
8. The hand-held computing device according to Claim 1, wherein the processor is programmed to perform steps (a)-(c) in response to a user tapping on the displayed term.
9. The hand-held computing device according to Claim 8, wherein the processor is programmed to perform steps (a)-(c) in response to the user tapping twice in succession on the displayed term.
10. The hand-held computing device according to Claim 1, wherein the reference title and the literary title are stored within a single file.
11. The hand-held computing device according to Claim 1 in combination with a cradle and a software application, the cradle adapted to receive the hand-held device to electrically couple the device to a general purpose computer, the application adapted to transfer works, including literary and reference works, to the hand-held device.

12. In a hand-held computing device that is adapted to be used to read literary works, a method of facilitating the comprehension of a literary work, the method comprising the computer-implemented steps of:

(a) displaying the literary work to the user on a touch-sensitive display of the device, the literary work stored in a memory of the device in a digital form;

5 (b) in response to user selection of a displayed term of the literary work for look-up, searching for the term in a reference work, the reference work stored in the memory of the device in a digital form; and

(c) displaying search results from step (b) on the touch-sensitive display.

10 13. The method of Claim 12, wherein a plurality of reference works are stored in the memory of the device, and the method further comprising identifying a reference work that corresponds to the literary title.

14. The method of Claim 12, wherein the reference work is a language-to-language translator, and step (c) comprises displaying a translation of the displayed term on the touch-sensitive display.

15 15. The method of Claim 12, wherein the reference title comprises an audio clip which is stored in association with the term, and step (c) further comprises audibly outputting the audio clip on a speaker of the computing device.

16. The method of Claim 17, wherein the step of outputting comprises generating an audible pronunciation of the displayed term.

20 17. In a hand-held computing device, a method of routing a citation to a destination, the method comprising the computer-implemented steps of:

(a) displaying a title to a user on a touch-sensitive display of the hand-held computing device, the title stored in the memory of the device in digital form;

25 (b) in response to user selection of a citation from the title and at least one routing address, storing a data record within the memory, the data record representing the citation and the routing address; and

(c) transferring the citation and the routing address to a general purpose computer that is programmed to route the citation based on the routing address.

18. The method of Claim 17, wherein step (c) is performed automatically when a communications link is established between the hand-held device and the general purpose computer.

30 19. The method of Claim 17, wherein step (c) is performed automatically when the hand-held device is placed in a cradle that is connected to the general purpose computer.

20. The method of Claim 19, wherein step (c) comprises transferring a plurality of citations and a plurality of routing addresses to the general purpose computer.

35 21. The method of Claim 17, wherein step (c) comprises routing the citation to at least one of an email address, a facsimile number, a printer, and a file folder.

22. The method of Claim 17, further comprises displaying a dialog box on the display, the dialog box prompting a user to select one or more destinations.

5 23. The method of Claim 17, wherein step (b) further comprises adding an annotation entered by the user to the data record, and step (c) comprises transferring the annotation to the general purpose computer.

24. The method of Claim 17, wherein step (b) further comprises:
adding beginning and ending markup language tags to the data record; and
adding markup language formatting tags in effect at the start of the citation to the data record.

10 25. The method of Claim 17, wherein step (b) further comprises automatically adding to the data record a tag that identifies the title.

26. The method of Claim 17, wherein the step of storing comprises storing pointers to a start and end of the citation in the data record.

27. The method of Claim 17, wherein step (a) comprises displaying a book title on the touch-sensitive display, the book title stored in the memory in an encrypted form.

15 28. A general purpose computer having a cradle connected thereto, the cradle adapted to receive a hand-held computing device, the general purpose computer having a processor programmed to receive and route citations stored within a memory of the hand-held device by performing at least the following steps:

(a) detecting the presence of the hand-held computing device in the cradle;
(b) automatically receiving a plurality of citations and a plurality of destination addresses from
20 the hand-held computing device via the cradle; and
(c) automatically routing the citations to destinations specified by the destination addresses.

29. A hand-held computing device, comprising:
a housing which supports a processor, memory, and a touch-sensitive display, the touch-sensitive display having an icon displayed thereon, the icon representing a user-definable function key; and
25 user interface code stored in the memory and adapted to be executed by the processor, the user interface code providing at least one menu, the at least one menu including menu items that can be selected for execution by the user by touching corresponding portions of the touch-sensitive display, the user interface code further including:

function key execution code which executes a menu item that is currently assigned to
30 the function key when the user touches and releases the function key; and
function key assignment code which assigns a new menu item to the function key when the user performs a drag-and-release operation on the touch-sensitive display between the icon and the new menu item.

30. The hand-held computing device according to Claim 29, wherein the function key assignment code
35 assigns a new menu item to the function key when the user performs a drag-and-release operation from the icon to the new menu item.

31. The hand-held computing device according to Claim 30, wherein the function key assignment code visually marks a currently touched menu item on the touch-sensitive display during the drag-and-release operation to enable the user to visually confirm a menu item being touched.

5 32. The hand-held computing device according to Claim 29, wherein the function key assignment code assigns a new menu item to the function key when the user performs a drag-and-release operation from the new menu item to the icon.

33. The hand-held computing device according to Claim 29, wherein the icon is fixedly displayed on the touch-sensitive display.

10 34. The hand-held computing device according to Claim 29, wherein the function key execution code executes the menu item currently assigned to the function key only if no menu is open on the display when the function key is touched.

35. The hand-held computing device according to Claim 29, wherein the memory includes system code stored therein for allowing the user to download encrypted literary titles to the memory and to select individual literary titles for viewing.

15 36. The hand-held computing device according to Claim 29, wherein the housing includes a gripping portion formed along one edge of the touch-sensitive display, and the user interface code provides an option for allowing the user to select a display orientation which corresponds to the user's preference for gripping the device.

20 37. The hand-held computing device according to Claim 36, in combination with a cradle that is adapted to receive the device and interconnect the device with a general purpose computer, wherein the user interface code is adapted to automatically set the display orientation to a base setting in response to placement of the device in the cradle, the base setting facilitating the viewing of content with the device in the cradle.

38. A method of facilitating the adjustment of an orientation of content that is displayed on a touch-sensitive display of a hand-held computing device, the touch-sensitive display having four edges, the method comprising:

25 providing an orientation key which comprises a generally orientation-independent graphical image depicting a function associated with the key;

in response to actuation of the orientation key by a user while viewing content on the display, displaying a plurality of graphical orientation markers on the display, each orientation marker corresponding to a respective orientation setting and graphically indicating a target top edge of the display; and

30 in response to selection of one of the markers by the user, clearing the plurality of orientation markers from the display and adjusting the orientation of the content to a setting which corresponds to the selected marker;

wherein the method facilitates the ability of the user to select a desired physical device orientation prior to selecting a new display orientation.

35 39. The method of Claim 38, wherein the step of displaying a plurality of orientation markers comprises displaying a plurality of arrows, each arrow pointing to a different respective edge of the display.

40. The method of Claim 39, wherein the step of displaying a plurality of arrows comprises displaying four arrows.

41. The method of Claim 40, wherein the step of displaying the four arrows comprises displaying one of the arrows in a highlighted form to indicate a current orientation setting.

5 42. The method of Claim 38, wherein the step of displaying a plurality of orientation markers comprises superimposing the markers on the displayed content.

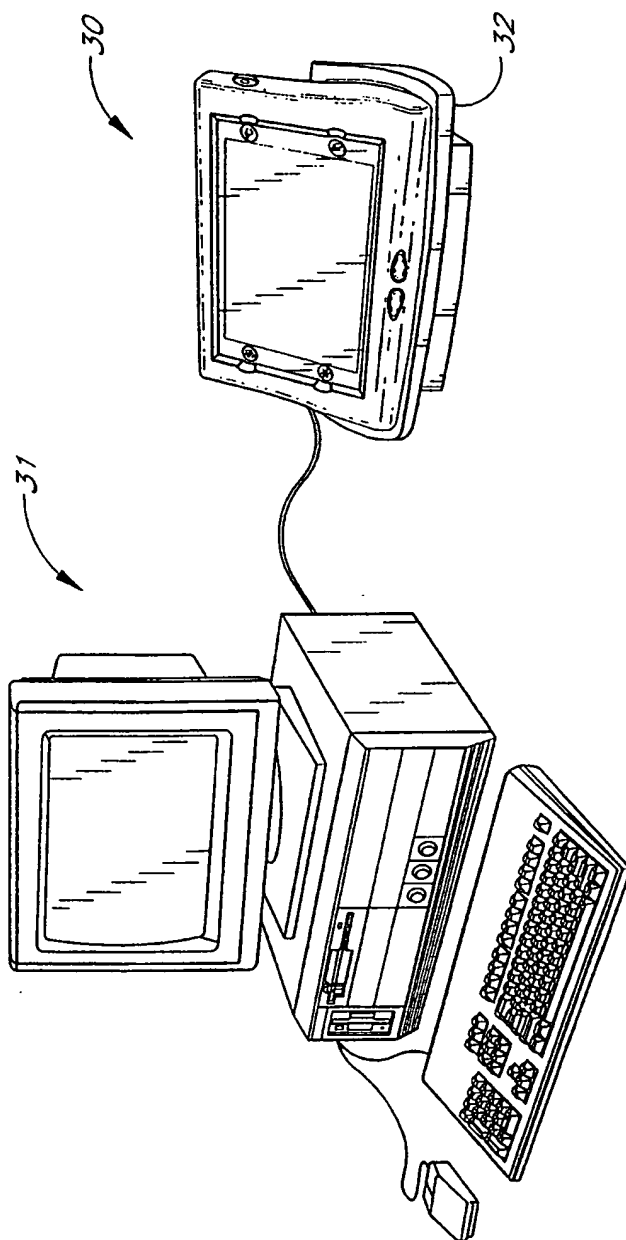
43. The method of Claim 38, wherein the step of displaying a plurality of orientation markers comprises positioning each marker adjacent to a respective edge of the display.

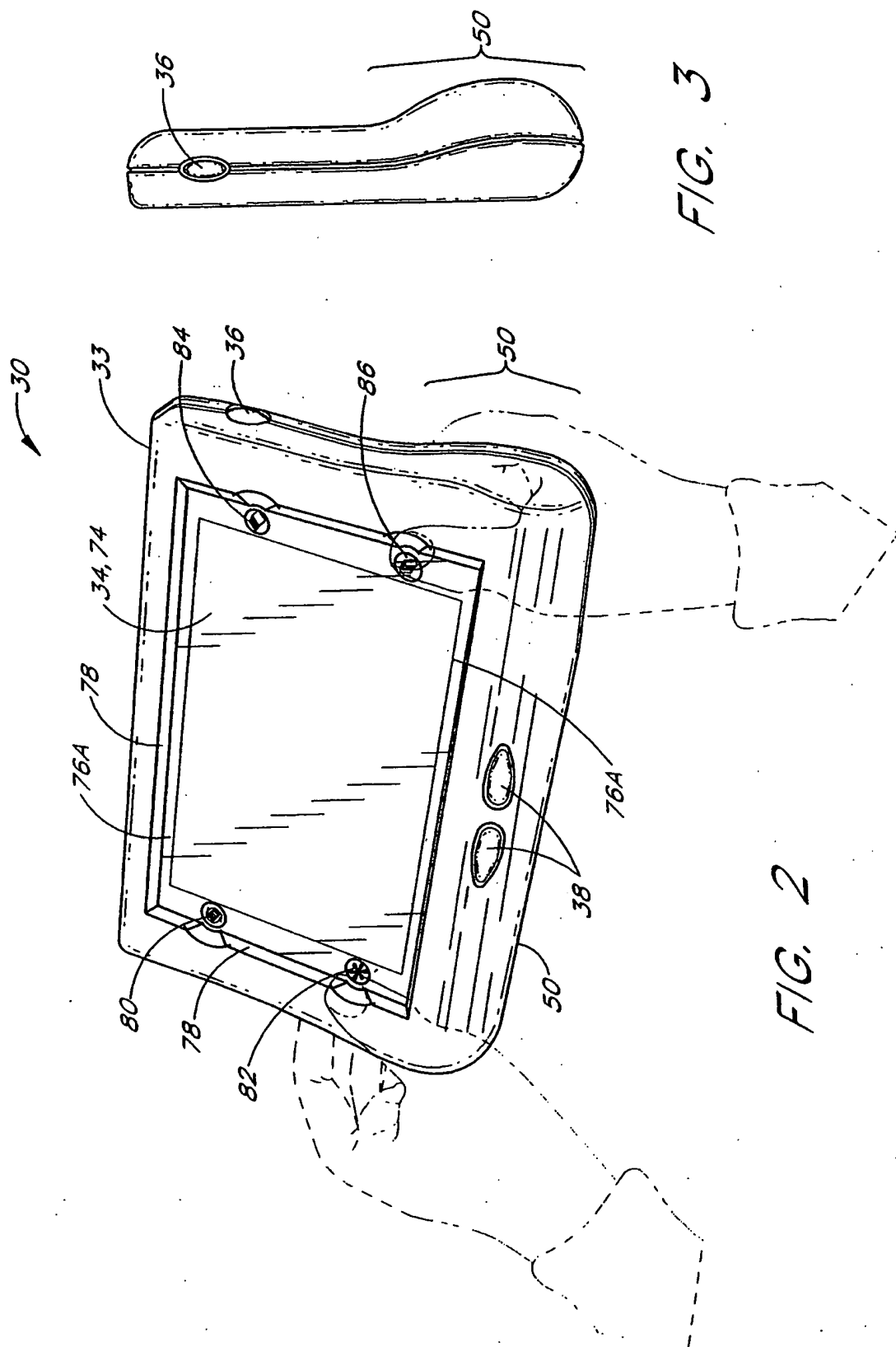
10 44. The method of Claim 38, wherein the step of providing an orientation key comprises providing an orientation-independent fixed icon on the touch-sensitive display.

45. The method of Claim 38, wherein the hand-held device is adapted to be placed within a cradle that connects to a general purpose computer, and wherein the method further comprises:

15 responding to placement of the device within the cradle by automatically adjusting the display orientation from a first setting to a second setting, the second setting facilitating the viewing of content while the device is in the cradle.

46. The method of Claim 45, further comprising responding to removal of the device from the cradle by restoring the orientation to the first setting.





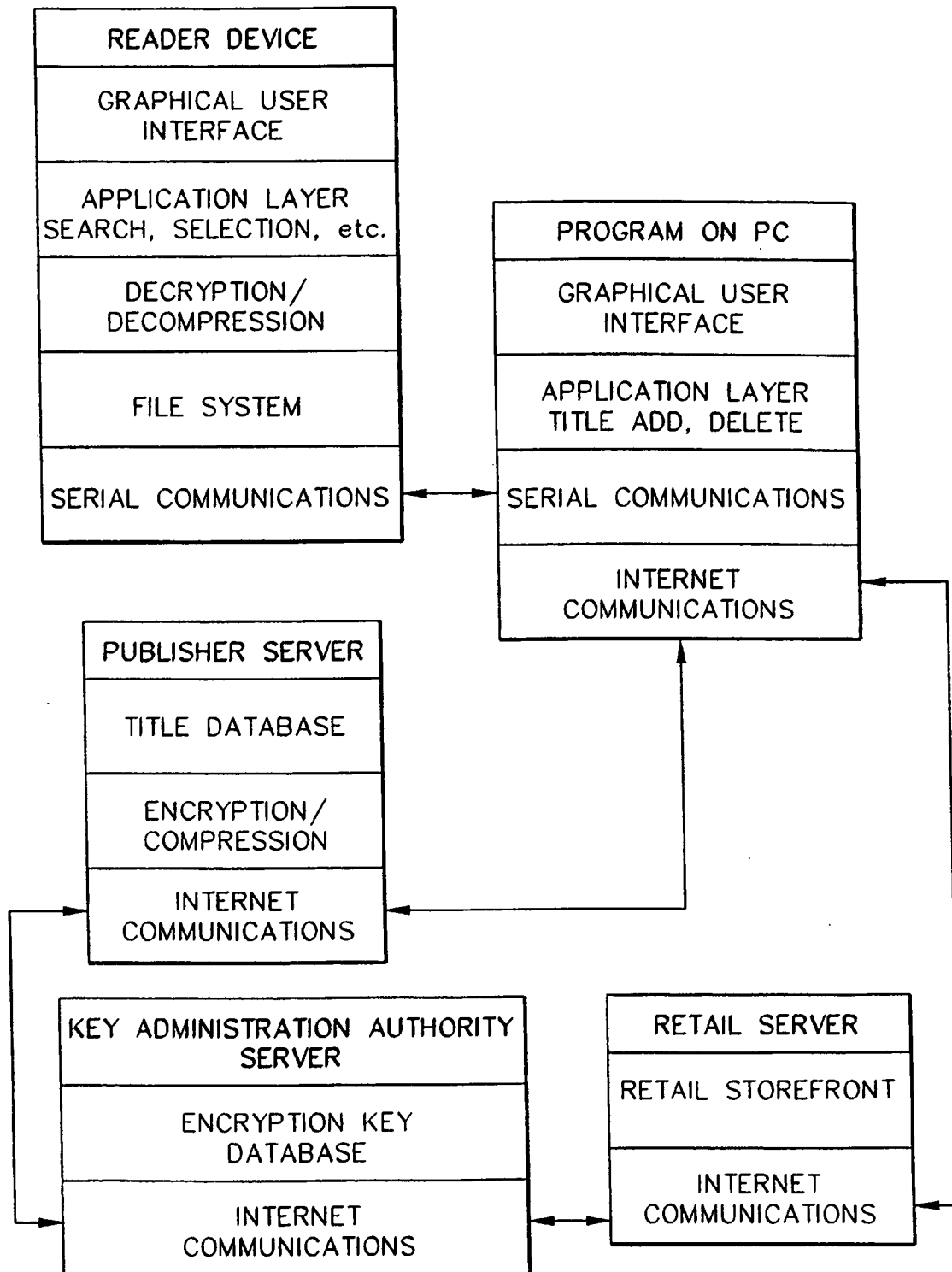
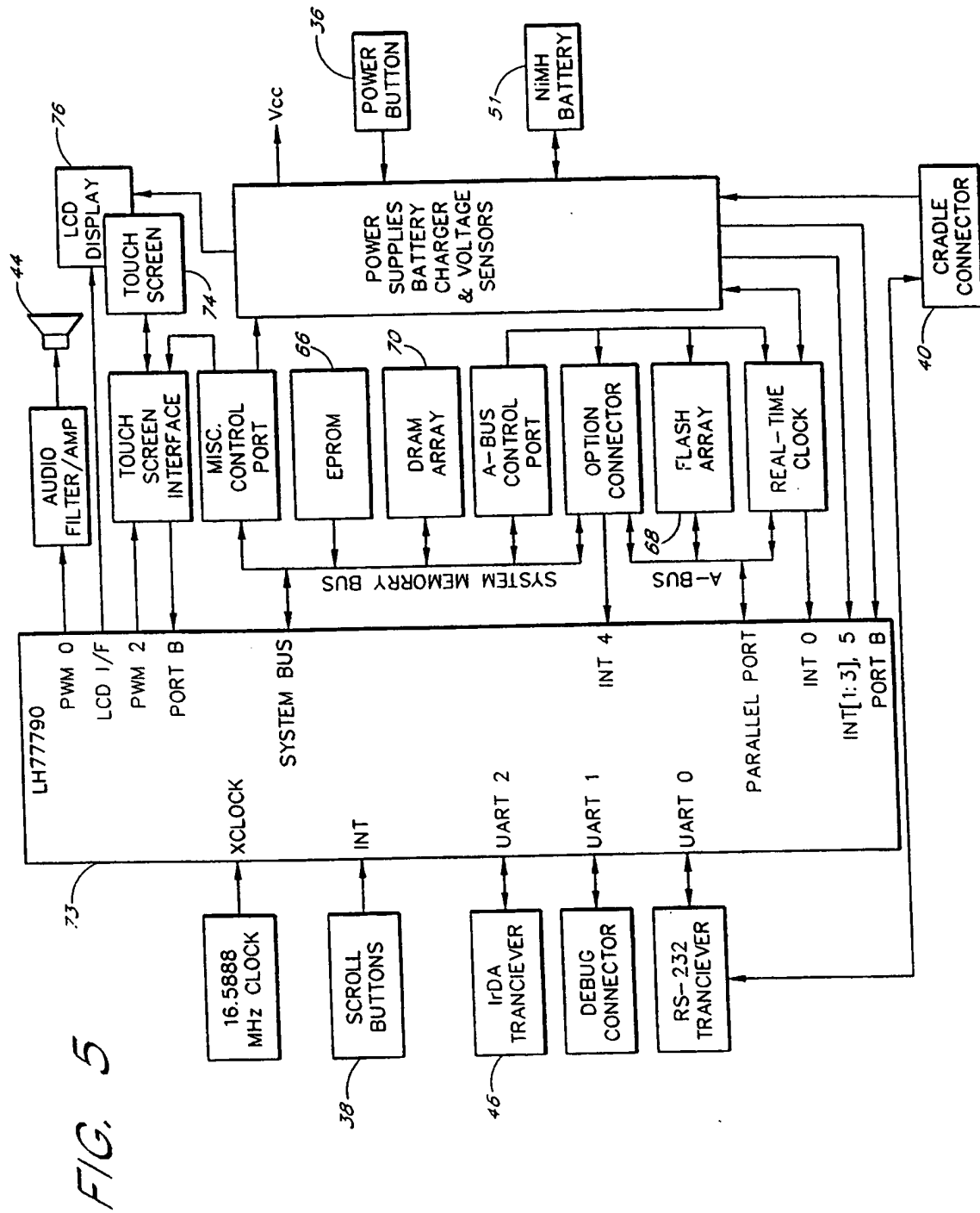
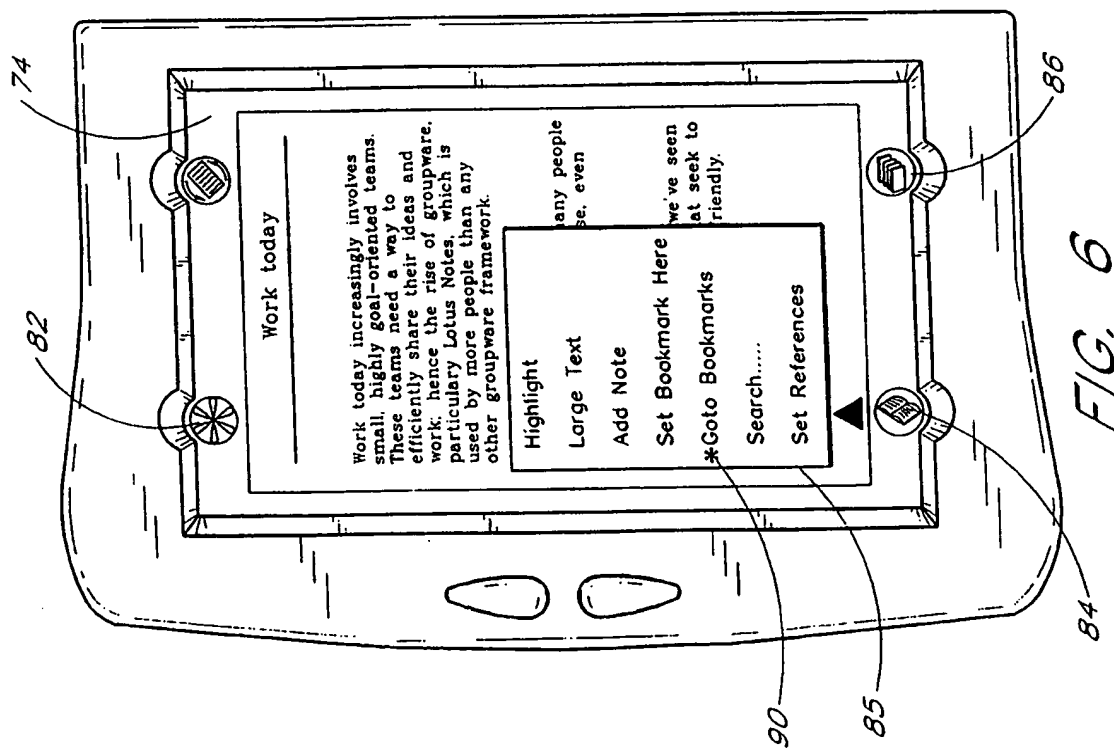
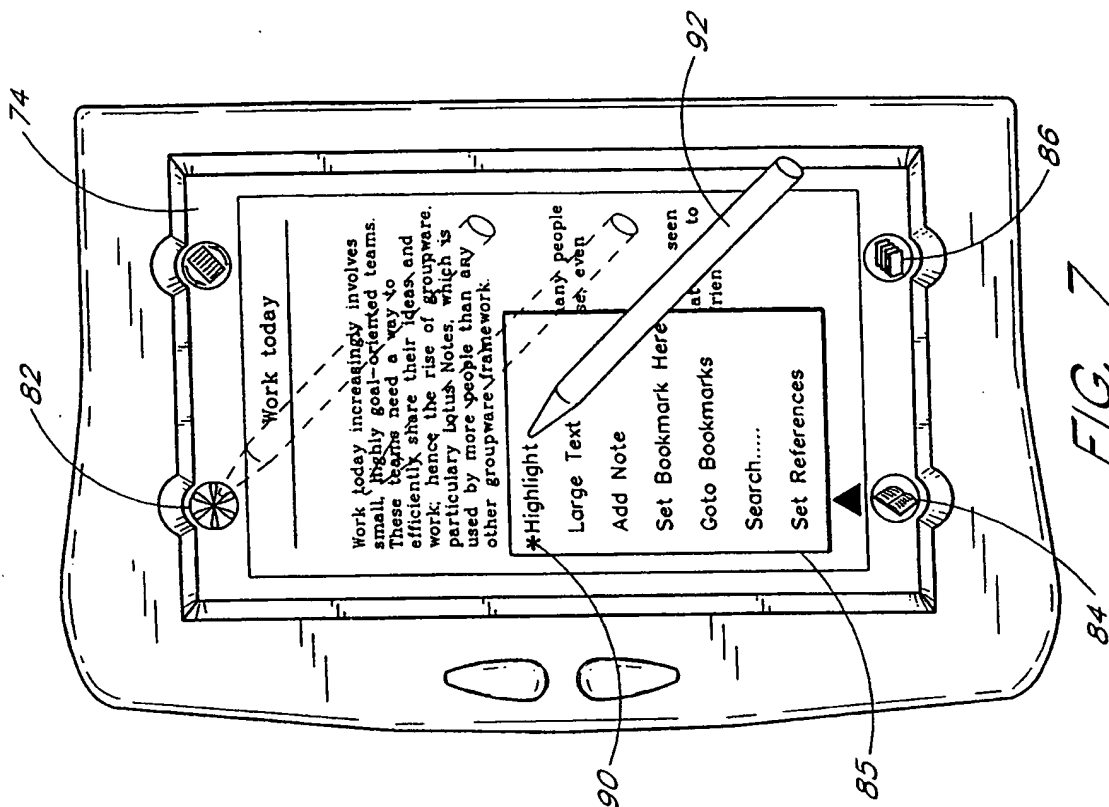


FIG. 4





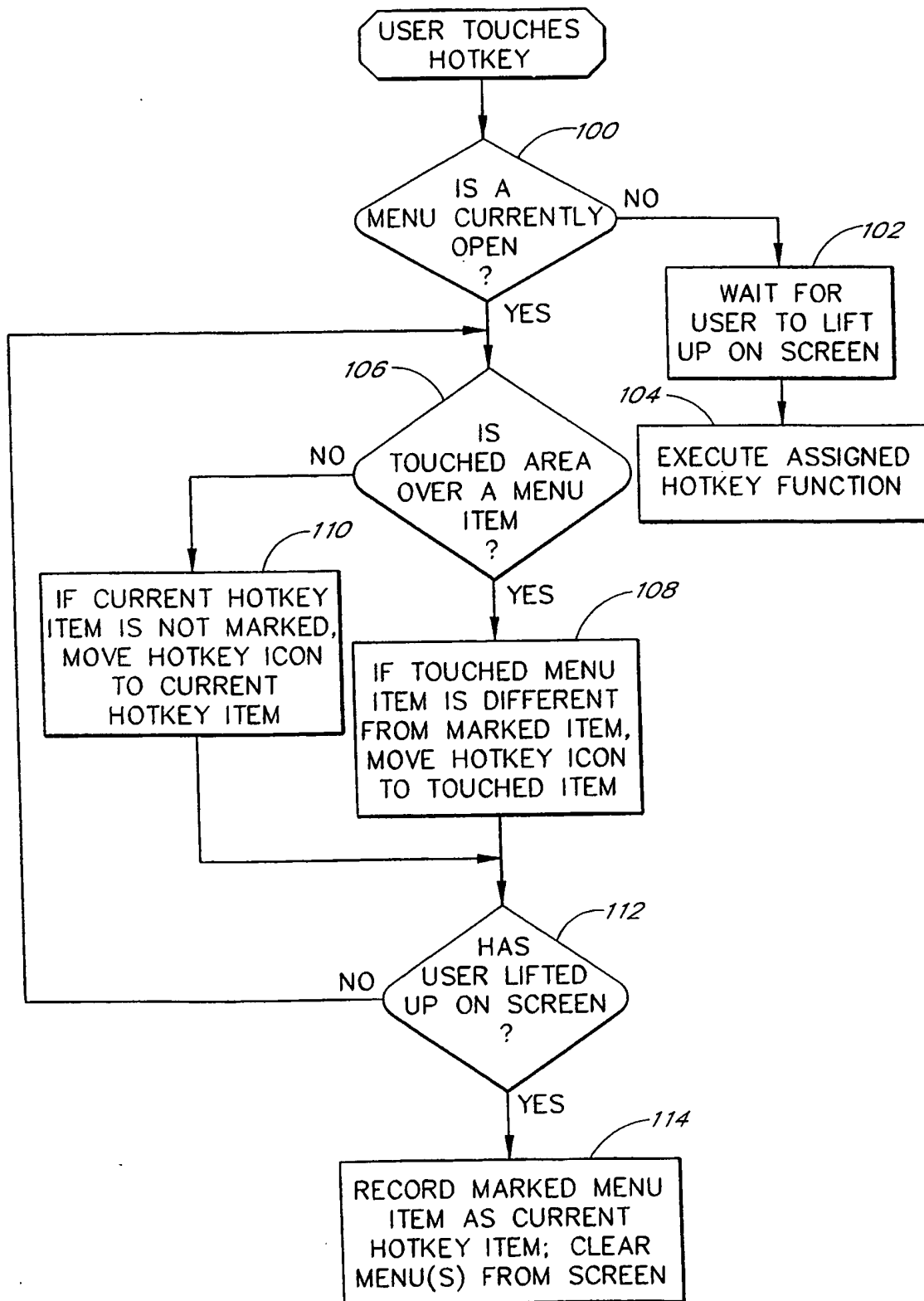


FIG. 8

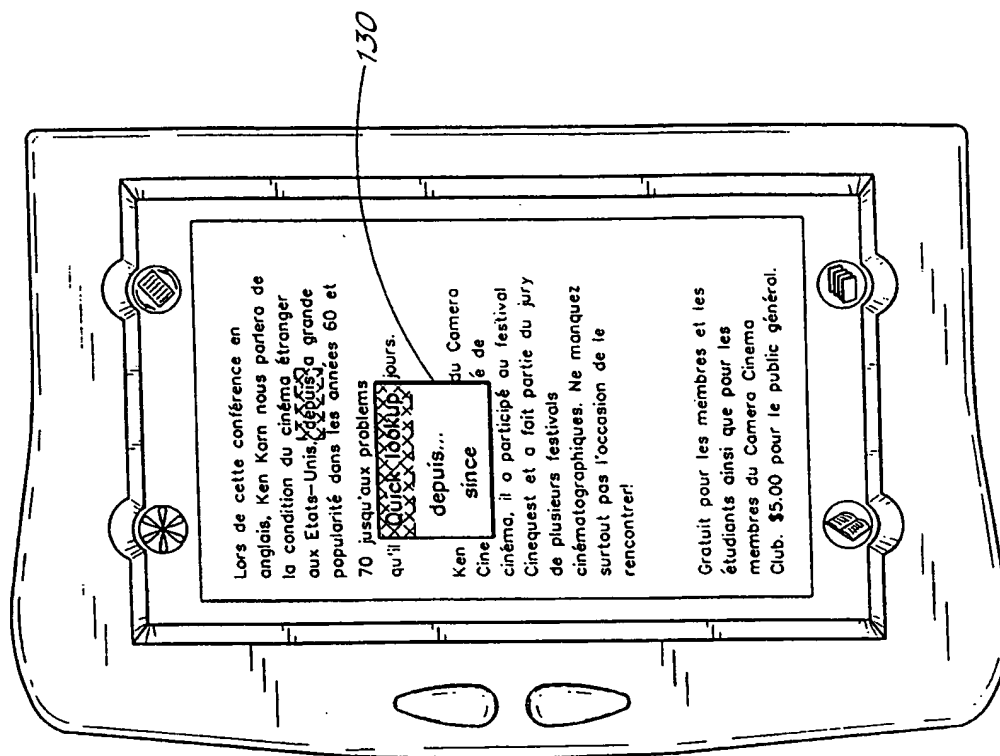


FIG. 9

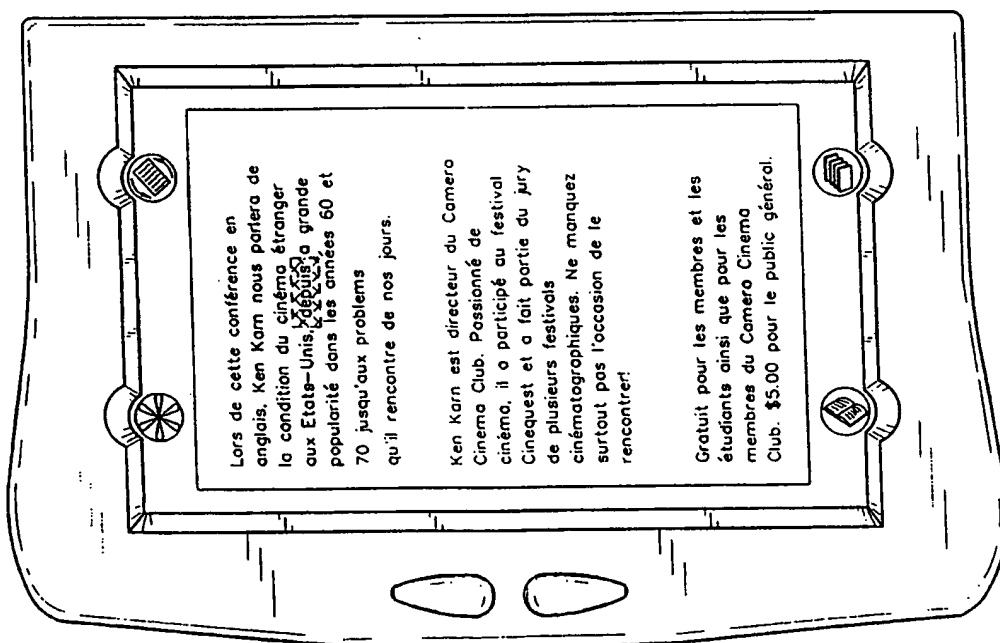
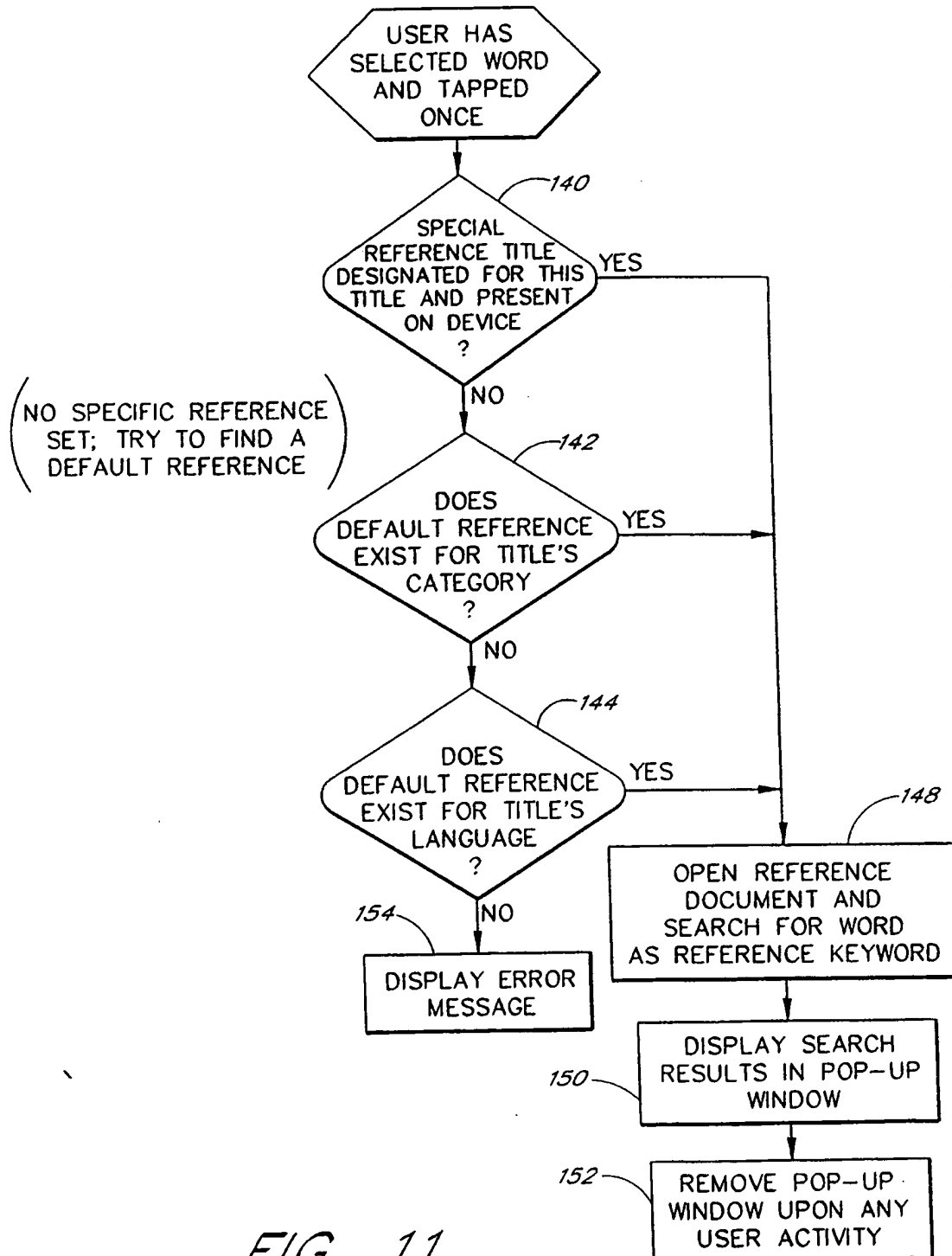


FIG. 10



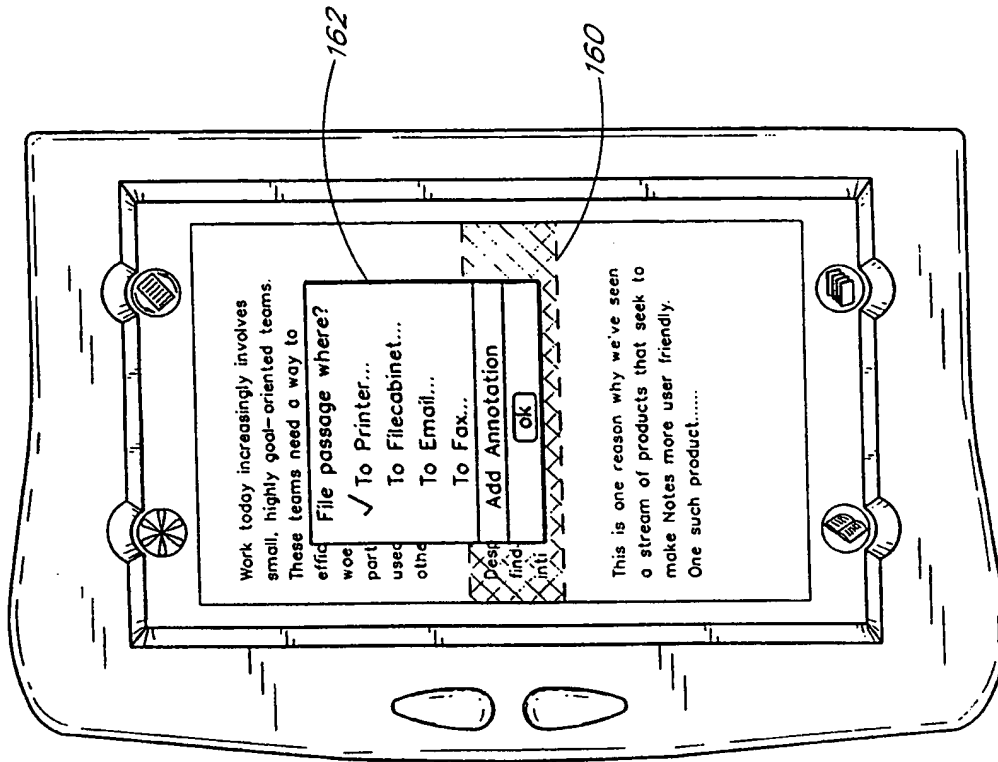


FIG. 12

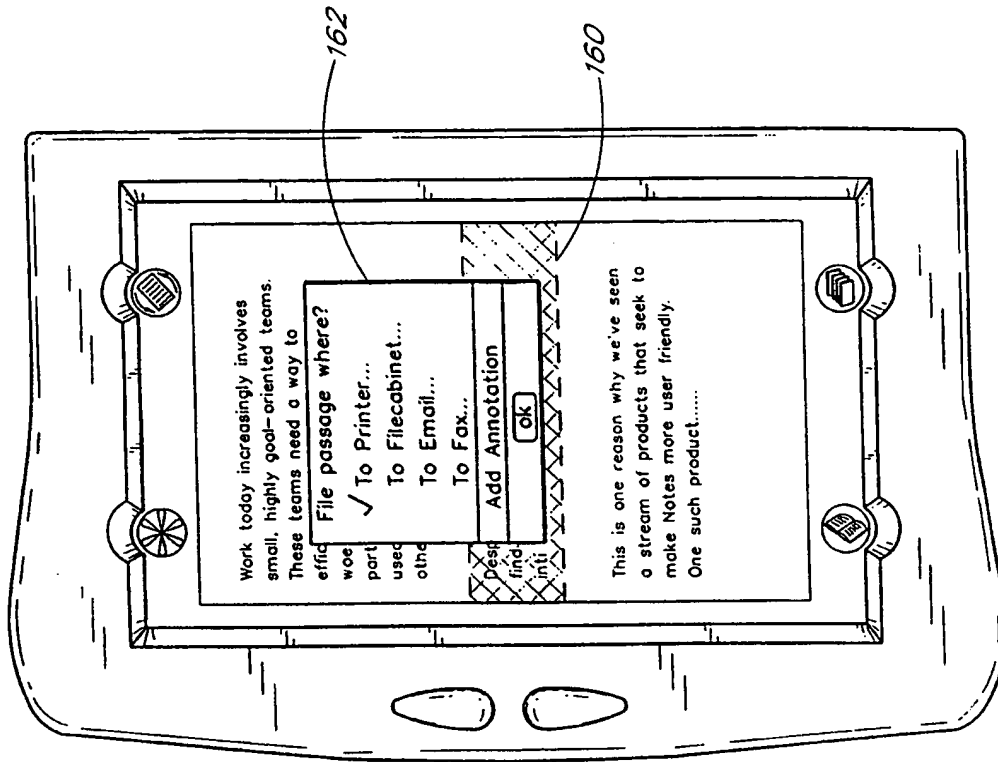


FIG. 13

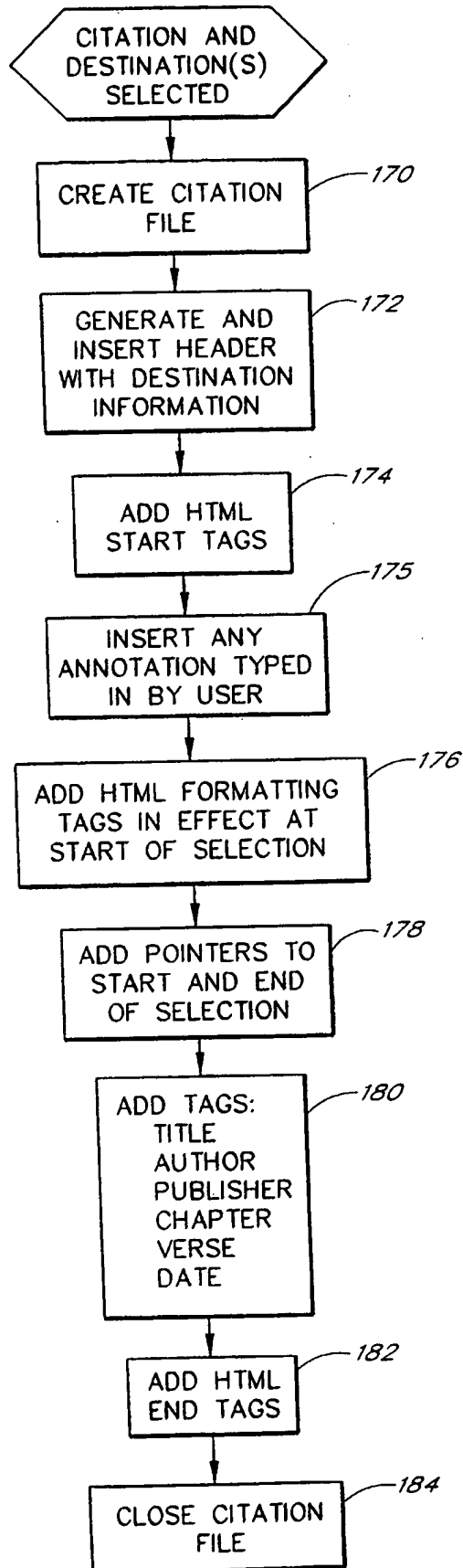


FIG. 14

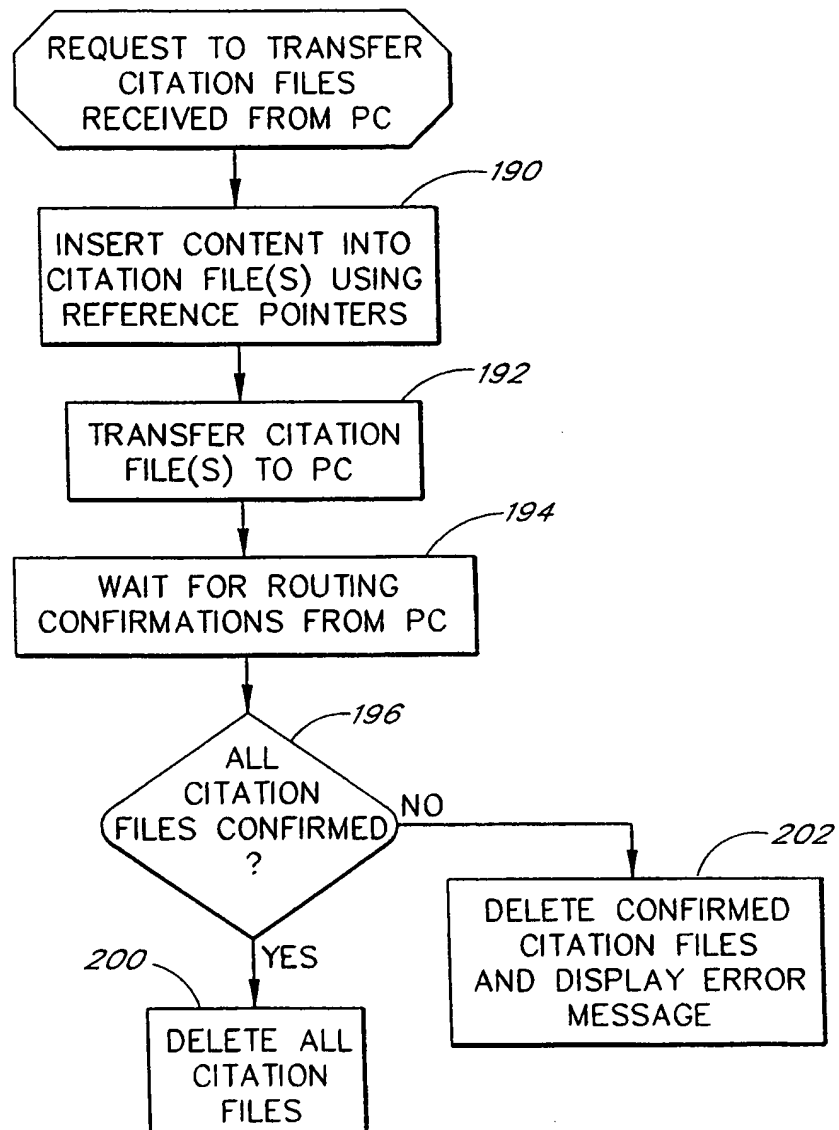


FIG. 15

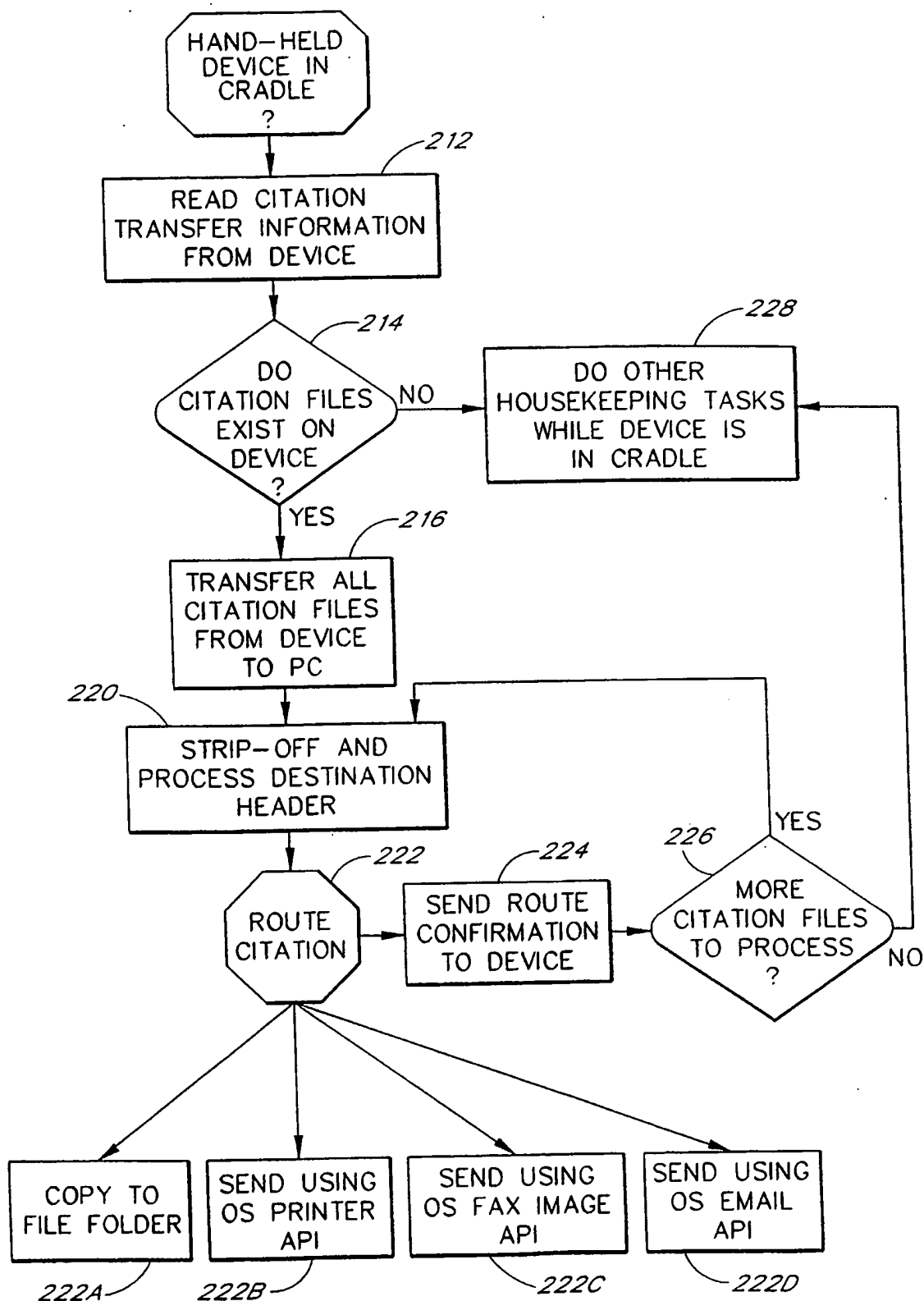
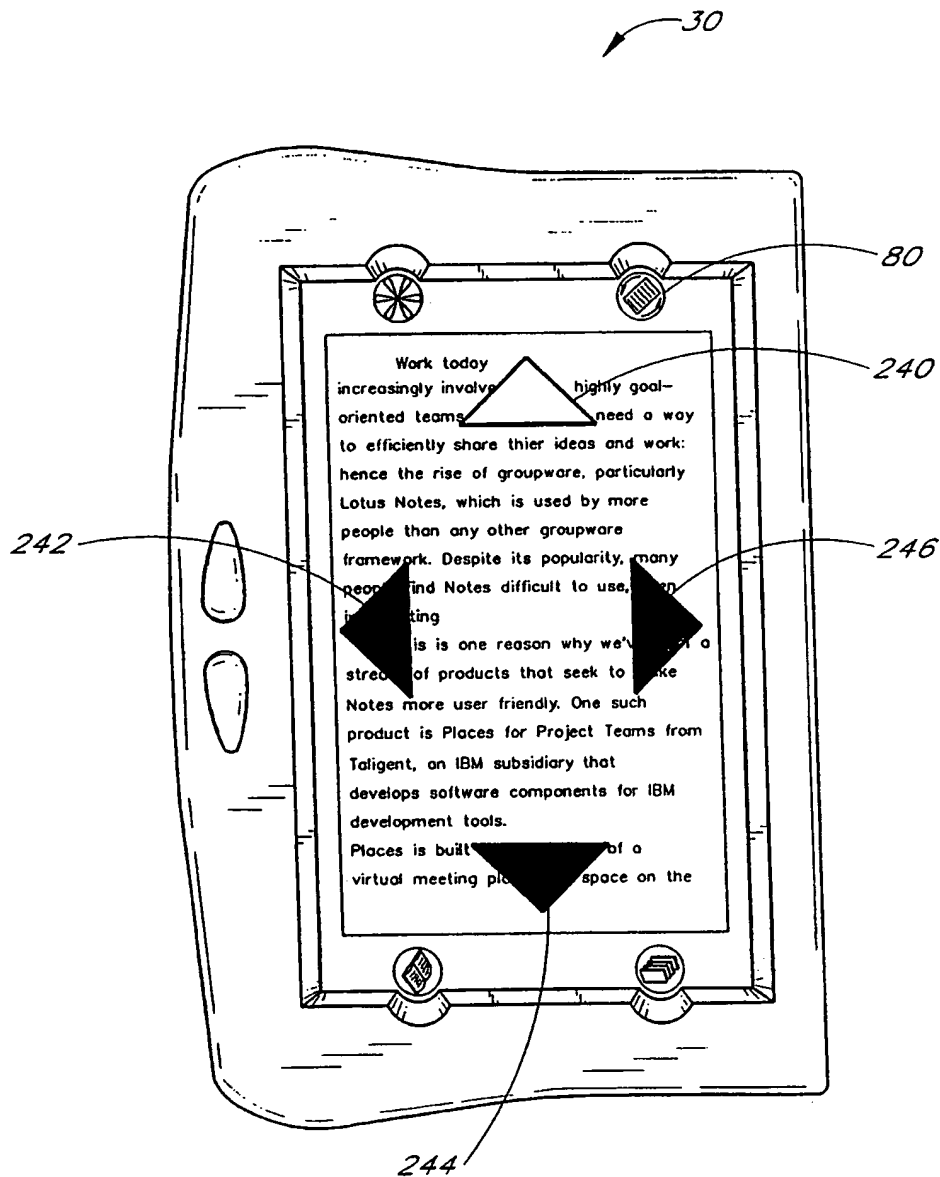


FIG. 16



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FIG. 17

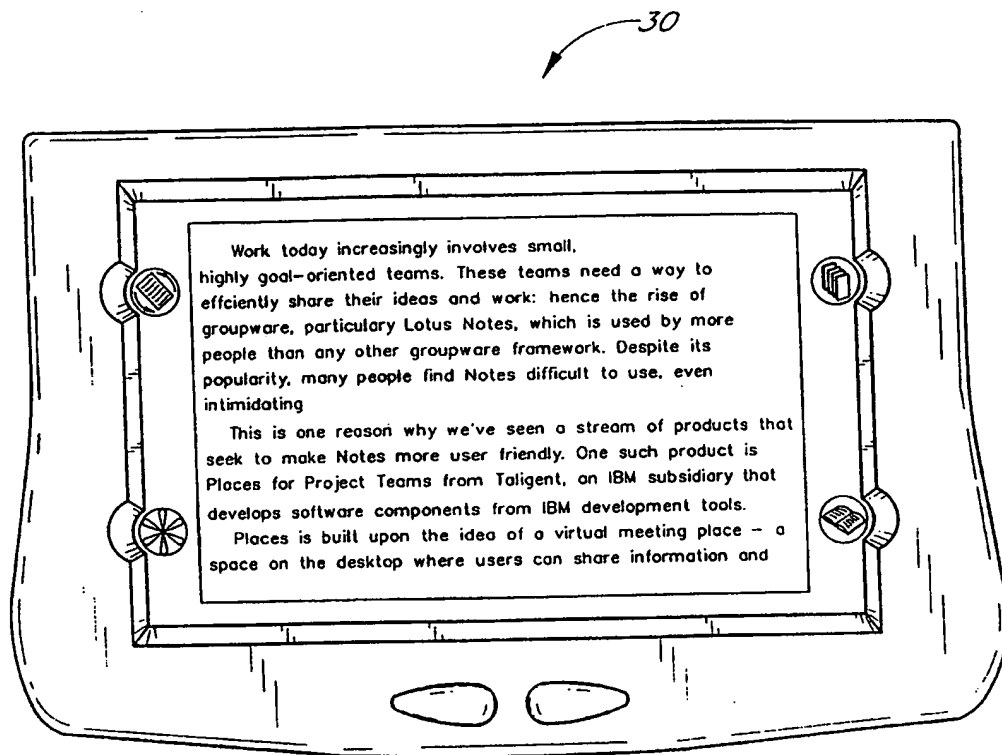
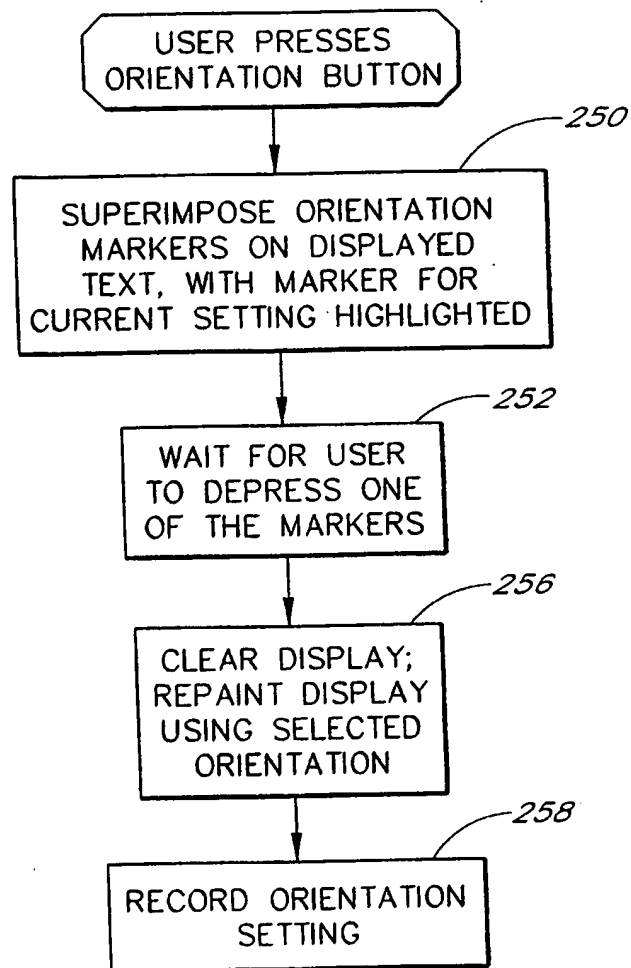


FIG. 18

*FIG. 19*

INTERNATIONAL SEARCH REPORT

International application No.
PCT/US99/03179

A. CLASSIFICATION OF SUBJECT MATTER

IPC(6) : G06F 3/00

US CL : 345/329

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 345/329

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

APS

search terms: electronic book, dock, titles

C. DOCUMENTS CONSIDERED TO BE RELEVANT

| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
|-----------|--|-----------------------|
| A | US 4,160,242 A (FOWLER et al.) 03 July 1979, Fig. 1, col. cols. 2-3. | 1-46 |
| A | US 4,972,496 A (SKLAREW et al.) 20 November 1990, Figs. 2, 10-12G, cols. 12-13. | 1-26 |
| A | US 5,467,102 A (KUNO et al.) 14 November 1995, Fig. 2-3, 11, cols. 10-11. | 1-46 |
| A | US 5,663,748 A (HUFFMAN et al.) 02 September 1997, Figs. 5-11, col. col. 9, line 30 to col. 12, line 35. | 1-46 |
| A | US 5,696,982 A (TANIGAWA et al.) 09 December 1997, Fig. 19. | 1-46 |
| A, P | US 5,774,109 A (WINKSY et al.) 30 June 1998, Figs. 1, 4A-9C. | 1-46 |

☒ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

| | |
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Date of the actual completion of the international search

14 JULY 1999

Date of mailing of the international search report

02 AUG 1999

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INTERNATIONAL SEARCH REPORT

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PCT/US99/03179

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| Category* | Citation of document, with indication, where appropriate, of the relevant passages | Relevant to claim No. |
| A, P | US 5,847,698 A (REAVEY et al.) 08 December 1998, col. 8, line 50 to col. 9, line 10. | 1-46 |
| A, E | US 5,897,324 A (TAN) 27 April 1999, Fig. 2. | 1-46 |
| A, E | US 5,909,207 A (HO) 01 June 1999, Figs. 2A-E. | 1-46 |
| A, E | US 5,914,707 A (KONO) 22 June 1999, Fig. 1, 7, 12. | 1-46 |